DOCUMENT RESUME

ED 221 353 SE 037 322

AUTHOR Tobin, Kenneth G.; Capie, William
TITLE Wait-Time and Learning in Science. AETS Outstanding Paper for 1981.
PUB DATE 81
NOTE 11p.

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Academic Achievement; College Science; Elementary School Science; Elementary Secondary Education; Higher Education; Process Education; *Questioning Techniques; *Science Education; *Science Instruction; Secondary School Science; *Student Behavior; *Teacher Behavior; Teacher Education; Teaching Methods
IDENTIFIERS *Science Education Research; *Wait Time

ABSTRACT

An understanding of classroom learning requires careful analyses of variables constituting the learning environment. Among those most likely influencing learning are verbal behaviors, since verbal interaction is the principal mode of communication in most classrooms. Thus, the quality of verbal interaction may directly affect the amount of learning that occurs. Although much research on verbal interaction has dealt with aspects of teacher questioning, the results have tended to be inconsistent. In contrast, a variable called "wait-time," which is related to the duration of certain pauses between speakers, has been shown to have a consistent effect on the quality of verbal interaction that occurs in classrooms. Using the preceding as a rationale, the nature of wait-time is discussed, followed by three alternative conceptualizations (definitions) of wait-time. Results from several wait-time studies are reviewed, reporting the changes in student/teacher behavior resulting from prolonging wait-time, effects on process variables, effects on science achievement and other variables, and studies related to changing teachers' wait-time behavior. (Author/SK)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

FD221353

AETS Outstanding Paper for 1981

Wait-Time and Learning in Science

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

This document has been reproduced as received from the person or organization originating it.

Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

Kenneth G. Tobin
Department of Mathematics and Science
Mount Lawley College
Perth, Australia

William Capie
Department of Science Education
University of Georgia
Athens, Georgia

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Kenneth Tobin

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

SE 037 322

Published by Carolina Biological Supply Company, Burlington, NC 27215

Wait-Time and Learning in Science

A general concern for improving science achievement has been consistently expressed through a vast number of studies with science achievement as a dependent variable. In some instances the achievement measures have been related to conceptual understandings, while in other cases the focus has been on process skills. As a result of these studies, a large number of achievement related teaching strategies, pupil behaviors, and pupil attributes have been identified. In fact, a review of the literature in science education would indicate that a great deal is known about teaching and learning science at all grade levels. Much of the progress in understanding teaching and learning has occurred in the nineteen-seventies. Paradoxically, a long term decline in overall science achievement during the same decade is also well documented in the literature (e.g., Ahmann, Crane, Searls and Larson, 1975; Helgeson, Blosser and Howe, 1977).

Other findings from the literature suggest that the types of behaviors exhibited by pupils in science classes are not necessarily those intended by curriculum designers. For example, Rowe (1974a) found that the quantity and quality of pupil inquiry exhibited in elementary classrooms using *Science Curriculum Improvement Study* materials was generally low. In a middle school science study Tobin and Capie (1980a) reported that the incidence of objectives-related pupil behavior (engagement) was low and that the predominant mode of pupil engagement was attending to the teacher. The average percentage of student off-task behavior in the Tobin and Capie study was 37 percent. A problem that has persisted, despite promising research findings, is a general decline in science achievement coupled with low rates of academic engagement.

Rationale

An understanding of classroom learning requires careful analyses of the variables that constitute the learning environment. Among those that are most likely to influence learning are verbal behaviors since verbal interaction is the principal mode of communication in most classrooms. Thus, the quality of the verbal interaction may directly affect the amount of learning that occurs. Although much of the research on verbal interaction has dealt with aspects of teacher questioning the results have tended to be inconsistent (cf. Winne, 1979). In contrast, a variable called wait-time, which is related to the duration of certain pauses between speakers, has been shown to have a consistent effect on the quality of verbal interaction that occurs in classrooms.

Rowe (1974a) discovered that the quality of the verbal interaction that occurred in classrooms was related to the duration of pauses separating speakers. When the average length of pauses was greater than approximately three seconds, desirable characteristics of student behavior were evident. Two types of pauses were identified: Wait-time I was defined as the length of time a teacher pauses after asking a question; and wait-time II was defined as the time a teacher waits after a pupil response before a comment is made or another question is asked.

The effects of teaching behaviors on pupil learning can be considered readily with the model proposed by Medley, Soar and Soar (1975). The model (Figure 1) highlights the mediating influence of pupil learning experiences on any effect attributable to teacher performance. Within this framework, a major purpose of teacher activity in a

science lesson would be to focus pupil learning experiences on to the instructional objectives. Thus a teacher question, direction, or explanation is most effective when pupil engagement is enhanced. If higher cognitive level objectives such as developing conceptual understandings or using process skills are the focus of a question or direction, students need sufficient time to attend to what has been said, and to engage in an appropriate manner. From an intuitive viewpoint, more time should be required for students to respond appropriately with higher cognitive level behaviors than for responses requiring lower cognitive level behaviors such as recalling factual information. Unless sufficient time is provided for pupils to do what was required by the question or direction, the intended mode of pupil engagement is unlikely to occur.

Figure 1. A process-product model of classroom learning.

Teacher silence is also important when students are speaking. As Rowe (1974a) noted, speech is delivered in sequences which are separated by pauses. As the cognitive level of the discourse is increased, the duration of the pauses which separate sequences tends to increase. The increased length of pauses provides opportunities for an unwary teacher to interrupt pupil discourse, thereby preventing the cognitive activity that would have occurred if the discourse had been completed.

In an instructional setting the use of an extended wait-time provides pupils with additional time to engage in objectives-related activity by thinking or elaborating a response. The process-product model suggests that increases in the quantity and quality of pupil behaviors should result in concomitant increases in pupil achievement. Thus, the use of an increased wait-time should enhance achievement by providing increased opportunities for pupils to practice the objectives. Undoubtedly other instructional variables and pupil attributes are also important and would need to be considered by teachers during instruction or by researchers planning a study. For example, questions should be clearly stated, referenced at an appropriate cognitive level for a given learner, and should be posed at a suitable time during the lesson. Variables such as these are readily accommodated into the process-product model and their effects on pupil behaviors and achievement can be investigated along with teacher variables such as wait-time.

In the remainder of this paper, the literature on wait-time is synthesized to contrast alternative conceptualizations of wait-time, to document the effects of variations in wait-time, to assess the efficacy of training teachers in wait-time strategies and to consider the implications of wait-time for pupil learning in science classrooms.

Alternative Conceptualizations of Wait-Time

Teachers continue to have difficulty in maintaining an average wait-time greater than three seconds (e.g., Garigliano, 1972; Lake, 1973; Rowe, 1974a; Tobin, 1980), and effective training programs for extending wait-time have not been documented. Although the original definitions of wait-time proposed by Rowe were useful in establishing wait-time as an important classroom variable, they are difficult to use in training contexts because teachers do not have absolute control over the length of the relevant pause. Student talk can reduce the length of wait-time I.

Lake (1973) suggested that wait-time should be redefined in terms of the period of silence that precedes teacher talk. His suggestion was made as an attempt to overcome difficulties encountered in implementing an extended wait-time. Lake defined two species of wait-time in terms of the speaker who has primary control over the length of the pause. Each definition was also broadened to encompass all categories of speech. Teacher wait-time was defined as the length of the pause preceding teacher talk. Student wait-time was similarly defined as the length of the pause preceding student talk. The two types of wait-time are presented diagramatically in Figure 2. Teacher or student talk can precede the relevant pause in either case.

Rowe's Definitions of Wait-Time			
Wait-Time I:	Teacher question	pause	Teacher or student talk
Wait-Time II:	Student response	pause	Teacher comment or question
Lake's Definitions of Wait-Time			
Teacher Wait-Time			
Example 1:	Student talk	pause	Teacher talk
Example 2:	Teacher talk	pause	Teacher talk
Student Wait-Time			
Example 1:	Teacher talk	pause	Student talk
Example 2:	Student talk	pause	Student talk
Fowler's Definitions of Wait-Time			
Teacher Reaction Wait-Time			
Example:	Student talk	pause	Teacher talk
Student Reaction Wait-Time			
Example:	Teacher talk	pause	Student talk
Teacher Initiated Wait-Time			
Example:	Student talk	pause	Student talk
Student Initiated Wait-Time			
Example:	Teacher talk	pause	Teacher talk

Figure 2. Schematic representation of different definitions of wait-time.

From the perspective of experimental research in which wait-time is to be manipulated, teacher wait-time has an advantage in that the teacher has primary control over the length of the relevant pause. Teachers do not control wait-time I which can be terminated with either teacher or student talk. This difficulty was highlighted in De Ture's (1979) training study in which no teacher attained an average wait-time I above 1.8 seconds.

Since teacher wait-time is defined such that all types of verbal interaction are encompassed, research hypotheses involving teacher wait-time will guide investigations into general effects of extending the length of teacher pauses. Similarly, student wait-time is broadly defined and can be used to investigate general effects of extended student pauses. In contrast, wait-time I is related to teacher questioning and wait-time II is specifically tied to teacher talk which follows a student response.

The conceptualization offered by Lake has been supported empirically in a study by Fowler (1975). He partitioned wait-time into four species: teacher reaction wait-time; student reaction wait-time; teacher initiated wait-time; and student initiated wait-time. These wait-time pauses are presented diagramatically in Figure 2. By partitioning wait-time in this way a broad range of hypotheses can be tested. In a factor analysis of six wait-time variables, Fowler identified two factors which he described as student controlled silence and teacher controlled silence. This outcome lends support to the decision to define wait-time in terms of the person having primary control over the length of the silent pause.

Research reported by Tobin (1980), and Tobin and Capie (1980a), has indicated that teacher wait-time is a valuable variable in understanding classroom processes. Additional research is needed to determine whether student wait-time can also be validated against student verbal behaviors and achievement. Researchers should remember, however, that a decision to use one definition over another in a study has implications for the interpretation of experimental results as different hypotheses are being tested.

Synthesis of Wait-Time Studies

The work of Rowe (1974a) was comprehensive, covering many studies conducted over a number of years. From an analysis of more than 300 classroom tape recordings, Rowe found a mean wait-time I of one second and a mean wait-time II of .9 seconds. When mean teacher wait-time was extended beyond three seconds, however, significant improvements were observed on ten student outcome variables.

1. The length of student responses increased;
2. the number of unsolicited, but appropriate, responses increased;
3. failure to respond decreased;
4. confidence, as reflected by a decrease in the number of inflected responses, increased;
5. the incidence of speculative responses increased;
6. the incidence of child-child comparisons of data increased;
7. the incidence of evidence-inference statements increased;

8. the incidence of questions asked by students increased;
9. there was an increase in the incidence of responses emanating from students rated by the teacher as relatively slow learners; and
10. the variety in the type of verbal behavior of students increased.

Rowe also reported that a prolonged wait-time schedule produced desirable changes on three teacher variables:

1. the teacher demonstrated a greater response flexibility;
2. the teacher's expectations for the performance of students rated as relatively slow learners changed; and
3. the number and type of questions asked by the teacher changed.

A Threshold Phenomenon

Rowe (1974b) suggested the possibility of a mean wait-time threshold of about three seconds, below which there are no detectable changes in the level of output variables. As wait-time was extended beyond three seconds up to 4.5 seconds, there were also no detectable changes in the level of the output variables.

Some evidence for the presence of a threshold of approximately three seconds is evident in the literature. Studies reported by Garigliano (1972) and Arnold, Atwood and Rogers (1973) involved mean wait-times below the threshold values identified by Rowe. In each study the majority of the research hypotheses were found to be non-significant. Garigliano conducted a study similar to those reported by Rowe, but the participating teachers were unable to attain mean wait-times which exceeded the criterion. If, as has been suggested by Rowe, wait-time is a threshold phenomenon, the failure of the teachers to exceed the threshold would account for the failure to achieve significant results. Arnold et al. investigated the influence of lapse-time on the cognitive levels of questions and answers. Lapse-time was defined as the interval of silence following the final utterance of a teacher's question to the beginning of an oral response by a student. There was no attempt to vary lapse-time, and as a consequence, the mean lapse-time was less than the three second threshold. The relationship between lapse-time and response level of questions was found to be non-significant.

Effects on Process Variables

Boeck and Hillenmeyer (1973) investigated the relationship between cognitive level of questioning and wait-time I. The authors reported that wait-times were longer after high level questions than after low level questions. Arnold, Atwood and Rogers (1974) reported that students took more time to commence responses at the analysis level than responses at the knowledge, comprehension, application, synthesis and evaluation levels. The results reported in the study suggest that longer pauses preceded analysis and synthesis questions. Further research is needed, however, as the above results were based on only seven questions at the analysis level.

Several wait-time studies have replicated outcomes on variables similar to those reported by Rowe. For example, Lake (1973) demonstrated that the use of an extended wait-time led to an increase in the cognitive complexity of student responses; and that the incidence of conversational sequences and alternative explanations in student talk increased.

Fowler (1975) reported that the use of an increased wait-time (TRWT) led to an increase in student to student interactions, significant increases in the frequency of student initiated statements, and decreases in student interruptions. Winterton (1976) obtained similar results in a study of the effects of extended wait-time I and wait-time II on verbal response characteristics of Pueblo Indian students. Rice (1977) found that the cognitive level of questions increased and fewer questions were asked under extended wait-time I conditions.

Hassler, Fagan and Szabo (1980) replicated some of Rowe's research in language arts classes. They reported that teachers trained in wait-time techniques asked fewer questions; asked more higher level questions; and had longer student responses. Many of the hypothesized relationships for wait-time with verbal outcomes were non-significant but the results obtained are consistent with an interpretation that teachers in the wait-time treatment groups did not use a sufficiently long wait-time. This possibility was not discussed by the authors. Wait-time was not measured in the study since wait-time was regarded as a categorical variable based on whether or not teachers were asked to extend their wait-time. In view of the difficulties teachers appear to have in implementing both species of wait-time (e.g., Garigliano, 1972), teachers in the long wait-groups may not have used wait-times that differed from those of short wait-time teachers. As a consequence, the wait-time results from the Hassler et al. study must be regarded with caution.

Effects on Science Achievement and Other Variables

The study reported by Anderson (1978) involved a sample of 62 students randomly assigned to two treatment groups. Two outcomes were reported in favor of the use of an extended wait-time I. Longer student responses were associated with the use of extended wait-time, and physics content was perceived to be less difficult in extended wait-time classes. The short wait-time treatment was more effective than the long wait-time treatment for teaching physics facts and concepts to low ability students. A surprising outcome of the Anderson study was an increased apathy towards physics for students in the increased wait-time classes.

Marsh (1978) extended the wait-time concept to a non-school setting. Marsh reported that museum guides were able to increase the number of questions they received by using an extended wait-time of five to six seconds. Marsh did not provide a definition of wait-time in the report of the research.

Studies reported by Anshutz (1975), Riley (1980), Tobin (1980), and Tobin and Capie (1980a) investigated the effects of wait-time on student science achievement. Anshutz reported no science achievement differences between short and long wait-time I groups for students in grades 3 and 4. Riley reported an interaction between wait-time I and the cognitive level of questioning on science achievement for students in grades 1 through 5. A decrease in achievement occurred when wait-time was extended from medium to long for low level questions. In contrast, achievement was increased when wait-time was extended for high and mixed cognitive questioning. Riley suggested that the optimal wait-time to be used may be dependent on the cognitive level of questioning and the cognitive level of the outcomes to be achieved.

Tobin (1980) reported a significant relationship between teacher wait-time and science achievement for students in grades five, six and seven. The study also indicated

that extended teacher wait-time was beneficial for students operating at a concrete stage of cognitive development and for those at a formal stage.

In a more extensive study Tobin and Capie (1980a, 1980b) investigated the effects of an increased teacher wait-time on student engagement rates and integrated process skill achievement for students in grades six, seven and eight. Significant interactions were reported for wait-time with measures of classroom management, cognitive level of questioning, questioning relevance and questioning clarity. In all cases, intermediate wait-time values of approximately three seconds were favored over short and long wait-time values. When intermediate values of wait-time were maintained, student attending and generalizing behavior were enhanced when measures of classroom management, questioning relevance and questioning clarity were high. Student attending rates and integrated process skill achievement were also high when a wait-time of approximately three seconds was used in conjunction with a cognitive level of questioning represented by an approximate mix of 50 percent higher level questions and 50 percent lower level questions.

Changing Wait-Time Behavior

Other research has been primarily directed toward training teachers to implement an extended wait-time. Chewprecha, Gardner, and Sapianchai (1980) compared three training methods for modifying wait-time I. The use of instructional pamphlets was found to be more effective than qualitative or quantitative analyses of audio-tapes. However, neither of the latter analyses involved self-analysis. De Ture (1979) investigated the effects of feedback on the ability of teachers to implement an extended wait-time. Two methods of training were used, video and audio, with and without a feedback component. The use of a video technique, with feedback, enabled teachers to attain a mean wait-time II of 3.7 seconds, significantly higher than the mean wait-time attained by groups using other training techniques. No teachers in the study were able to attain an average wait-time I above 1.8 seconds. Since teacher behavior was being modified via the types of feedback given to teachers, the results are most encouraging. As feedback was not provided to students, wait-time I was probably reduced by student talk.

Esquivel, Lashier, and Smith (1978) reported that feedback on wait-time II did not lead to increased wait-time over a sequence of three science lessons. The results of a pilot study conducted by Swift (1980) described attempts to extend wait-time I and wait-time II with the aid of an electronic device called a wait-timer. The device consists of an audio tape recorder and a system of flashing lights which indicate when a specified period of silence has elapsed. The lights can be seen by the teacher and students. Preliminary data suggest more success in enhancing wait-time I, possibly by increasing the period of time that students are prepared to wait. Although wait-time II was significantly increased, the average was only 1.8 seconds.

The training studies highlight the need to extend two types of pauses, the pauses that precede teacher talk and the pauses that precede student talk. The definitions of teacher wait-time and student wait-time are consistent with the pauses that need to be manipulated. Teacher talk cannot reduce student wait-time, and student talk cannot reduce teacher wait-time. As a consequence, teacher wait-time and student wait-time are advocated as definitions suited for use in training programs and studies.

Summary of Implications

Rowe's initial contentions about the effects of increased wait-time are well known. They have been replicated in a host of well conceived studies in the last decade. In general, the quality of classroom discourse improves when teachers are able to extend wait-times. Her suspicion that wait-time is a threshold phenomenon has been confirmed, as well, for a number of studies have shown that a wait-time of about three seconds or more is critical in creating desirable outcomes. While the improved quality of inquiry behaviors is significant, more important documentation of the effects of wait-time has been demonstrated in the last five years. A number of researchers have gone beyond improved classroom interaction patterns to examine the effects of increased wait-time on achievement as well. Not surprisingly, achievement of high-level objectives tends to be enhanced with longer wait-times. Short wait-times may be more effective with lower level objectives, however, only one study suggests this to be so. Recent research shows that wait-time interacts with other measures of teacher quality with maximum effectiveness at wait-time levels of three seconds. Perhaps the effective use of wait-time also enhances other effective teaching practices such as classroom management.

Much of the ambiguity in the effectiveness of changing teachers' wait-time behavior may be a problem of conceptualization and control. Clearly, teachers alone cannot control pupil wait-time, but they can control teacher wait-time. While the research suggests that wait-time should be extended for high level objectives, common sense suggests that teachers should focus on extending "teacher wait-time."

References

Ahmann, J.S., Crane, R., Searls, D., & Larson, R. Science achievement: The trend is down. *The Science Teacher*, 1975, September, **42**(16), 23-25.

Anderson, B.O. The effects of long wait-times on high school physics pupils' response length, classroom attitudes and achievement. (Doctoral dissertation, University of Minnesota, 1978.) *Dissertation Abstracts International*, 1978, **39**, 3493A. (University Microfilms No. 78-23,871).

Anshutz, R.J. An investigation of wait-time and questioning techniques as an instructional variable for science methods students microteaching elementary school children. (Doctoral dissertation, University of Kansas, 1973.) *Dissertation Abstracts International*, 1975, **35**, 5978A. (University Microfilms No. 75-06,131).

Arnold, D.S., Atwood, R.K., & Rogers, V.M. Question and response levels and lapse time intervals. *The Journal of Experimental Education*, 1974, **43**, 11-15.

Arnold, D.S., Atwood, R.K., & Rogers, V.M. An investigation of relationships among question level, response level and lapse time. *School Science and Mathematics*, 1973, **73**, 591-594.

Atwood, R.K., & Stevens, J.T. Relationships among question level, response level and lapse time: Secondary science. *School Science and Mathematics*, 1976, **76**, 249-254.

Boeck, M.A., & Hillenmeyer, G.P. *Classroom interaction patterns during microteaching: Wait-time as an instructional variable*. A paper presented at the annual meeting of the American Educational Research Association, New Orleans, Louisiana, March, 1973. (ERIC Document Reproduction Service No. ED 076574).

Chewprecha, T., Gardner, M., & Sapianchai, N. Comparison of training methods in modifying questioning and wait-time behaviors of Thai high school chemistry teachers. *Journal of Research in Science Teaching*, 1980, **17**, 191-200.

DeTure, L.R. Relative effects of modeling on the acquisition of wait-time by preservice elementary teachers and concomitant changes in dialogue patterns. *Journal of Research in Science Teaching*, 1979, **16**, 553-562.

Esquivel, J.M., Lashier, W.S., & Smith, W.S. Effect of feedback on questioning of preservice teachers in SCIS microteaching. *Science Education*, 1978, **62**, 209-214.

Fowler, T.W. *An investigation of the teacher behavior of wait-time during an inquiry science lesson.* A paper presented at the annual meeting of the National Association for Research in Science Teaching, Los Angeles, California, March, 1975. (ERIC Document Reproduction Service No. ED 108 872).

Garigliano, L.T. The relation of wait-time to student behaviors in Science Curriculum Improvement Study lessons. (Doctoral dissertation, Columbia University, 1972.) *Dissertation Abstracts International*, 1973, **33**, 4199-A. (University Microfilm No. 73-02595).

Hassler, D.M., Fagan, E.R., & Szabo, M. *A successful transplant of wait-time and questioning strategies to children's oral language behaviors.* A paper presented at the annual meeting of the National Association for Research in Science Teaching, Boston, April, 1980.

Helgeson, S., Blosser, P., & Howe, R. *The status of precollege science, mathematics and social science education: 1955-1975. Volume I: Science education.* (NSF-C762067) Washington, DC: National Science Foundation, 1977.

Lake, J.H. The influence of wait-time on the verbal dimensions of student inquiry behavior. (Doctoral dissertation, Rutgers University, 1973.) *Dissertation Abstracts International*, 1973, **34**, 6476-A. (University Microfilm No. 74-08866).

Marsh, C.A. Social-psychological influences upon the expression and inhibition of curiosity. (Doctoral dissertation, George Washington University, 1978.) *Dissertation Abstracts International*, 1978, **39**, 445-B.

Medley, D.M., Soar, R.S., & Soar, R. *Assessment and research in teacher education: Focus on PBTE.* Washington, DC: American Association of Colleges for Teacher Education, June 1975.

Rice, D.R. The effect of question-asking instruction on preservice elementary science teachers. *Journal of Research in Science Teaching*, 1977, 353-359.

Riley, J.P. II. *The effects of teachers' wait-time and cognitive questioning level on pupil science achievement.* A paper presented at the annual meeting of the National Association for Research in Science Teaching, Boston, April, 1980.

Rowe, M.B. Wait-time and rewards as instructional variables, their influence on language, logic and fate control: Part one—Wait-time. *Journal of Research in Science Teaching*, 1974a, **11**, 263-279.

Rowe, M.B. Pausing phenomena: Influence on the quality of instruction. *Journal of Psycholinguistics Research*, 1974b, **3**, 203-223.

Swift, J.N. Personal communication. April 16, 1980.

Tobin, K.G., The effect of an extended teacher wait-time on science achievement. *Journal of Research in Science Teaching*, 1980, **17**, 469-475.

Tobin, K.G., & Capie, W. The effects of teacher wait-time and questioning quality on middle school science achievement. *American Educational Research Journal*, 1980a, (Paper submitted for publication).

Tobin, K.G., & Capie, W. The relationship of selected dimensions of teacher performance with student engagement. *Journal of Educational Psychology*, 1980b, (Paper submitted for publication).

Winne, P.H. Experiments relating teachers' use of higher cognitive questions to student achievement. *Review of Educational Research*, 1979, **49**, 13-50.

Winterton, W.W. The effect of extended wait-time on selected verbal response characteristics on some Pueblo Indian children. (Doctoral dissertation, University of New Mexico, 1976.) *Dissertation Abstracts International*, 1977, **38**, 620-A. (University Microfilms No. 77-16,130).